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IDEA-0712-68
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18 September 1968

MEMORANDUM FOR THE RECORD

SUBJECT: U-2R Air Conditioning Meeting, 6 August 1968, LAC-Burbank

1. Subject meeting was held at 0800 hours on 6 Aug.1968. Attachment #1 is a list of primary attendees.

2. LAC representatives [redacted] presented the status of the U-2R Air Conditioning system, utilizing schematics, charts and graphs, included as Attachment #2. As an added agenda item, [redacted] presented information regarding LOX system difficulties encountered in the U-2R. The following paragraphs summarize the information presented and the status of the air conditioning system.

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3. Air Conditioning System Modifications. The latest modification consists of the following changes from the original system design:

A. An additional suit cooling line and control valve was added bringing cold air directly from the turbine to the pressure suit vent air line. This line was added to provide colder air for pilot comfort and to provide a higher pressure head to the suit. The latter occurs because the direct cooling line does not experience the water separator pressure drop. Because the cooling line bypasses the water separator, the suit cooling control will have to be closed to prevent icing in the line when operating below 25,000 feet in damp, cold climates. The temperature of the air delivered by the suit cooling line cannot be controlled by the pilot, and can range from $0^{o}F$ to $-70^{o}F$. This cold air is mixed with $40^{o}F$ to $100^{o}F$ air from the cockpit vent air line for delivery of air to the suit in a temperature range of $-30^{o}F$ to $+30^{o}F$. The suit cooling control only alters the flow quantity of cold air to the pilot's suit. In general, this modification allows the pilot to have suit ventilation air colder than cockpit air, but he can never have suit vent air warmer than cockpit vent air.

USAF review(s) completed.

B. A check valve was added to the suit ventilation line between the cockpit vent air line and the suit

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cooling line. This is required to prevent cold air from the suit cooling line, which has a 3 in. H_2O greater pressure head, from flowing out into the cockpit rather than through the suit. Check valves with various pressure drops (i.e., spring loaded valves), have been used in the modifications, as seen on the attached charts. However, information supplied since the 6 August 1968 meeting indicates that the final version is a simple flow check valve that is not spring loaded and has only a 1 in. H_2O pressure drop.

C. The suit vent boost valve orifice was reduced in diameter to increase the pressure drop across the valve in the maximum boost (i.e., closed) position. The available pressure drop across this valve, and hence the pressure head available to the suit vent line when set a maximum boost, is now 38 in. H_2O (1.37 psi above cockpit pressure). This will allow the pilot to inflate his suit to almost 1 psig for comfort or use of the urine elimination system and continue to have some vent air flow. In the event of cabin pressure loss without loss of engine bleed pressure (i.e., seal failure, etc.), by selecting maximum boost the pilot will have vent air supplied with sufficient pressure (approximately 4 psia) to overcome the inflated suit pressure and thus provide body cooling under such conditions. The only limitation or precaution that must be observed is that if maximum boost is selected for any reason under normal pressurization conditions at maximum design altitude [redacted], the Q-Bay altimeter must be monitored since Q-Bay pressure may start to decay. Available mass airflow through the air conditioning system is only sufficient to meet minimal pressurization and normal suit vent requirements at maximum design altitude, hence raising the back pressure under such conditions will reduce the volume output and result in reduction of Q-Bay pressure. Schematics of the system plumbing and airflow and pressure drop data are presented in Attachment #2. 25X1A

4. Air Conditioning System Contamination. The undersigned provided LAC representatives [redacted] 25X1A
25X1A [redacted] with copies of a chemical laboratory report produced

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25X1

by the David Clark Co. on the analysis of a contaminated vent flapper valve from an S-1010 PPA. LAC was asked to investigate the matter of contamination with regards to the possible effects on pressure suit structure and function.

25X1A 5. Supplemental Pilot Ventilation During Ground Operations. [redacted] raised the question of supplemental methods for suit ventilation during ground operations in the aircraft in hot climates. At low engine power settings during ground checks and taxiing, the mass air flow to the suit is low, hence some additional cooling provisions may be required.

25X1A [redacted] stated that their respective groups would continue to investigate this matter.

6. Air Conditioning System Status - Summary.

A. According to information presented, the U-2R Air Conditioning System now appears to be adequate in terms of providing sufficient body cooling under all normal flight conditions and in the event of cabin pressure loss due to seal failure or similar malfunction.

B. Supplemental cooling may be required during ground operations prior to launch, due to the low output of the air conditioning system at low power settings. This is considered to be an open item under investigation by both LAC and Detachment G.

C. Air conditioning contamination is considered to be an open item. Investigations regarding effects are to be conducted by both LAC and David Clark Co.

D. Appropriate precautionary notes have been included in special air conditioning operating instructions provided all pilots regarding the use of maximum suit vent boost and its adverse effects on Q-Bay pressure. Presumably such information will also be included in the U-2R-1 manual.

7. Added Agenda Item - LOX System Difficulties. Problems with the U-2R LOX system have included abnormally high pressures with subsequent overboard venting of LOX and low system pressures after various periods of flight. LAC was unable to supply specific answers to the causes for such difficulties. LOX converters were analyzed and found to be functioning normally. Servicing procedures (LOX filling, venting and purging) techniques were suspected, but moisture tests gave negative results. Insufficient heat exchange tubing was not felt to be the cause according to LAC. In summary, they did not know what caused the problems. They

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25X1

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25X1

had, however, added an additional 8 feet of heat exchanger line to each converter and had established changes in servicing and purging procedures which they hoped would solve the problems. No recurrences had occurred at the time of this meeting. This item is still considered to be an open item with more investigation required by LAC.

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[redacted]
ASD/R&D/OSA

Attachments -
As stated

25X1A ASD/R&D/OSA [redacted]:bjg
Distribution:
Cy 1 - D/R&D/OSA w/atts
2 - D/SA w/atts
3 - D/M/OSA w/atts
4 - D/M/OSA w/atts
5 - D/O/OSA w/atts
6 - SAS/O/OSA w/atts
7 - IDEA/O/OSA w/atts
8 - ASD/R&D/OSA w/atts
9 - PSD/R&D/OSA w/atts
10 - ASD/R&D Chrono w/o atts
11 - RB/OSA w/o atts

[redacted]
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